d) REMARKS

The claims are 1-5 and 11 with claim 1 being independent. Claim 8 has have been cancelled and its subject matter added to claim 1. Reconsideration of the claims is requested.

Claims 1-3, 5, 8 and 11 were rejected as obvious over Ikeda '683 in view of Parry '500 and Pang '628. Claim 4 was rejected as obvious over the same references further in view of Murakami '668. Ikeda is said to show a heated coil filament. Parry is said to show heating temperatures above 1000°C and a heated coil filament. The Examiner admits that neither Ikeda nor Parry disclose processes for silicon compound-based exhaust gases and powdery by-products. Pang is said to react silicon compound-based exhaust gases and powdery by-products by decomposition. The rejection is respectfully traversed.

Prior to addressing the grounds of rejection applicants wish to briefly review certain key features and advantages of the present claimed invention. Previously, in a CVD apparatus for forming a semiconductor thin film or a processing apparatus such as a deposited film etching apparatus, when a gas containing a silicon compound as a main component (e.g., SiH_4) was used, a powdery by-product was generated within the apparatus. The generated powdery by-product can contaminate the deposited film to be formed or may adhere to exhaust pipes or valves and block them. In addition, the pressure inside a processing chamber may be adversely influenced or an operational defect of a conductance adjusting valve may be caused by the presence of the powdery by-product.

When film formation or processing is performed under conditions such that the amounts of residual non-reacted gas and generated powdery by-product produced are

relatively small, the above-mentioned problems can be resolved by conventional processing methods such as those disclosed in the cited references. However, under more rigorous forming or processing conditions at higher deposition rates (e.g., 10 Å/sec to 50 Å/sec or more) of a deposited film, the amount of generated powdery by-product becomes quite large. As a result, it becomes difficult to handle such by-products by conventional exhaust processing methods and the above-mentioned problems become far more serious. The Examiner's attention is directed to specification Table 15, Example 36 and to Comparative Example 3 in which valves and pumps are blocked by powdery by-product at higher deposition rates from 10-20 Å/sec during conventional processing.

The above-mentioned problems are overcome by the present process in which a filament comprising a high-melting metal selected from tungsten, molybdenum and rhenium and having a single linear shape, a plurality of linear shapes, or a linear shape wound in spirals is heated to a temperature within the range of 1400˚C to 2200˚C. Not only non-reacted gases, but also powdery by-products, can efficiently be heated/decomposed and deposited as a hard film on a trap wall surface.

Specifically, by employing tungsten, molybdenum, or rhenium as the material of the filament, it is possible to improve the heat resistance and the durability in a reducing atmosphere containing H_2 which normally causes brittleness of the filament. Moreover, by heating the filament to a temperature of not less than 1400˚C, but no more than 2200˚C, it is possible to efficiently decompose a non-reacted gas as well as a by-product thereof to form a hard film on a trap wall surface. Further, by adopting the above-mentioned

temperature range, adverse effects on the vacuum seal (i.e., degradation or breakage thereof) of a processing apparatus can be averted.

In addition, by designing the filament in a single linear shape, a plurality of linear shapes, or a linear shape wound in spirals, the advantages of the present invention can be further enhanced. That is, by designing the filament in a single linear shape, a plurality of linear shapes, or a linear shape wound in spirals, the exhaust conductance in the exhaust pipes during processing can be maintained even when the filament is installed therein. As noted on specification page 53, line 9 to page 54, line 15 the mean velocity of gas where the chemical reaction occurs is greater than in the processing chamber, thereby preventing by-products from being deposited in the processing chamber.

Furthermore, by heating the filament to a temperature of not less than 1400˚C, but no more than 2200˚C, then even under severe forming or processing conditions with a higher deposition rate (e.g., 10-50 Å/sec or more) of a deposited film, the exhaust gas processing can be carried out without blocking exhaust pipes or conductance valves.

In conventional exhaust gas processing apparatuses or traps disclosed in the cited references, in order to attain efficient contact between the exhaust gas and heating means (e.g., filament), three-dimensional trap shapes such as shown in Figure 2 of Ikeda et al. (U.S. Pat. No. 5,819,683) have been adopted. On the contrary, in the present invention, by designing the filament in the above mentioned shapes, while heating the filament to a temperature of not less than 1400˚C but no more than 2200˚C, then even under severe processing conditions with a higher film deposition rate (to which the conventional processing technique is not applicable), the exhaust gas processing can be performed.

The cited references fail to teach or suggest the problems resulting from powder formation, such as generation of powdery by-product, its contamination of deposited films and its adherence to exhaust pipes or valves, resulting in blocking or the like. Furthermore, there is no disclosure in the cited references of using a filament with a single linear shape, a plurality of linear shapes, or a linear shape wound in spirals.

Therefore, a skilled artisan reading the cited references, even when considering the state of the art, would not arrive at the unique concept of heating a filament of the specified high-melting metal with the specified linear shape to the specified temperature of 1400˚C to 2200˚C to thereby decompose not only a non-reacted gas, but also a powdery by-product and to perform their deposition as a hard film, thus removing them from the exhaust gas.

The claims should be allowed and the case passed to issue.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

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